

IN THE CLAIMS

This listing of the claim will replace all prior versions and listings of claim in the present application.

Listing of Claims

1. (currently amended) A storage device control apparatus comprising:
 - ~~a mounting part capable of removably mounting;~~
 - a plurality of channel control units, each with a host interface controller
 - formed therein for receiving data input/output (I/O) requests;
 - a plurality of disk control units, each with a disk interface controller
 - formed therein for performing I/O control of the data to storage volumes
 - storing data in response to the data I/O requests;
 - a plurality of cache memory units, each with a memory formed therein
 - for temporarily storing the data being transferred between the channel control
 - units and the disk control units; and
 - a plurality of storage control units, each with the a host interface
 - controller, the a disk interface controller, and the a memory formed therein; and
 - an internal connection part for which allows said channel control units,
 - said disk control units, said cache memory units, and said storage control
 - units to each be independently connected or disconnected to said storage
 - device control apparatus in a communicable manner.
2. (original) A storage device control apparatus according to claim 1, wherein information for specifying the storage volumes to which one

storage control unit performs I/O control is stored in the memory of said storage control unit, and

at least either of information for specifying the storage volumes to which said disk control unit performs I/O control and information for specifying the storage volumes to which another storage control unit performs I/O control is stored in the memory of said storage control unit.

3. (currently amended) A storage device control apparatus according to claim 1, wherein the memory of each ~~said~~ storage control units ~~has~~includes:

a first storage area for storing ~~the~~ data to be stored in ~~the~~ storage volumes to which said storage control unit performs I/O control, and

a second storage area for storing the data to be stored in the storage volumes to which said disk control unit performs I/O control, and

wherein information for specifying the first and second storage areas are stored in the memory of said storage control unit.

4. (currently amended) A storage device control apparatus according to claim 1, wherein each ~~said~~ storage control unit includes a communication buffer for storing data exchanged with another storage control unit.

5. (currently amended) A control method for a storage device control apparatus including: ~~a mounting part capable of removably mounting a~~ plurality of channel control units, each with a host interface controller formed

therein for receiving data input/output (I/O) requests, a plurality of disk control units, each with a disk interface controller formed therein for performing I/O control of the data to storage volumes storing data in response to the data I/O requests, a plurality of cache memory units, each with a memory formed therein for temporarily storing the data being transferred between the channel control units and the disk control units, a plurality of storage control units, each with a ~~the~~ host interface controller, a ~~the~~ disk interface controller, and a ~~the~~ memory formed therein; and an internal connection part for connecting the channel control ~~unit~~ units, the disk control ~~unit~~ units, the cache memory ~~unit~~ units, and the storage control ~~unit~~ units in a communicable manner, wherein in which ~~a plurality of the storage control units each holds in the~~ which hold in each memory therein at least information for identifying a unit to perform I/O control to a storage volume to which a ~~each~~ data I/O request is directed ~~are mounted in the mounting part~~, said control method comprising the steps of:

receiving the data I/O request at one of said storage control unit;

referring to the information by the storage control unit to identify the ~~a~~ unit to perform I/O control to a ~~the~~ storage volume to which the data I/O request is directed; and

performing the I/O control by the storage control unit when the unit to perform the I/O control is the one storage control unit, or letting another storage control unit perform the I/O control when the unit to perform the I/O control is not the one storage control unit,

wherein said internal connection part allows the channel control units, the disk control units, the cache memory units, and the storage control units to

each be independently connected or disconnected to said storage device control apparatus.

6. (currently amended) A control method according to claim 5, wherein when the data I/O request received by one of the storage control units is a data read request, and the unit to perform the I/O control is not the one storage control unit, said step of carrying out the I/O control by said another storage control unit comprises the steps of:

sending the read request to said another storage control unit by the storage control unit;

performing the I/O control in response to the read request by said another storage control unit;

receiving data from said another storage control unit by the storage control unit; and

sending the received data to an information processing apparatus by the storage control unit.

7. (currently amended) A control method according to claim 5, wherein when the data I/O request received by one of the storage control units is a data write request, and the unit to perform the I/O control is not the one storage control unit, said step of performing the I/O control by said another storage control unit comprises the steps of:

sending the write request and write data to said another storage control unit by the one storage control unit; and

performing the I/O control of the write data in response to the write request by said another storage control unit.

8. (currently amended) A control method according to claim 7, further comprising the steps of:

receiving from said another storage control unit data indicating that the I/O control of the write data has been completed by the one storage control unit; and

sending the information processing apparatus data indicating that the I/O control has been completed, by the one storage control unit.

9. (currently amended) A control method according to claim 6, wherein the storage control unit includes a communication buffer for storing data exchanged with said another storage control unit,

said step of sending the read request to said another storage control unit by the one storage control unit comprises the steps of:

writing the read request into a communication buffer provided in said another storage control unit by the storage control unit, and

reading the read request from the communication buffer of said another storage control unit by said another storage control ~~the own-unit~~, and

said step of receiving the data from said another storage control unit by the one storage control unit ~~includes is-the~~ step of:

reading the data written by said another storage control unit in the communication buffer provided in the one storage control unit by the one storage control unit.

10. (currently amended) A control method according to claim 7, wherein the storage control unit includes a communication buffer for storing data exchanged with said another storage control unit, and

said step of sending the write request and the write data to said another storage control unit by the one storage control unit comprises the steps of:

writing the write request and the write data into a communication buffer provided in said another storage control unit by the one storage control unit, and

reading the write request and the write data from the communication buffer of said another storage control unit by said another storage control the own-unit.

11. (currently amended) A control method according to claim 8, wherein the storage control unit includes a communication buffer for storing data exchanged with said another storage control unit, and

said step of receiving data indicating that the I/O control of the write data has been completed from said another storage control unit by the one storage control unit, includes is the step of:

reading the data written by said another storage control unit in the communication buffer provided in the one storage control unit by the one storage control unititself.

12. (currently amended) A control method according to claim 225, wherein at least one storage control unit and one disk control unit are mounted in the mounting part, said method further comprising the steps of:

receiving the data I/O request by the at least one storage control unit; referring to the information by the at least one storage control unit to identify a the unit to perform the I/O control to a the storage volume to which the I/O request is directed; and

performing the I/O control by the at least one storage control unit when the unit to perform the I/O control is the at least one storage control unit, or performing the I/O control by a the disk control unit when the unit to perform the I/O control is not the at least one storage control unit.

13. (currently amended) A control method according to claim 12, wherein when the data I/O request received by the at least one storage control unit is a data read request, and the unit to perform the I/O control is not the at least one storage control unit, said step of performing the I/O control by the disk control unit comprises the steps of:

sending the read request to the disk control unit by the at least one storage control unit;

performing the I/O control in response to the read request by the disk control unit;

receiving data from the disk control unit by the at least one storage control unit; and

sending the received data to an information processing apparatus by the at least one storage control unit.

14. (currently amended) A control method according to claim 12, wherein when the data I/O request received by the at least one storage control unit is a data write request, and the unit to perform the I/O control is not the at least one storage control unit, said step of performing the I/O control by the disk control unit comprises the steps of:

 sending the write request and write data to the disk control unit by the at least one storage control unit; and
 performing the I/O control of the write data in response to the write request by the at least one storage control unit.

15. (currently amended) A control method according to claim 12, wherein the memory of the at least one storage control unit includes:

 a first storage area for storing the data to be stored in the storage volumes to which the at least one storage control unit performs I/O control, and

 a second storage area for storing the data to be stored in the storage volumes to which the disk control unit performs I/O control, wherein:

 when the unit to perform the I/O control is the at least one storage control unit, the at least one storage control unit performs the I/O control of the data to the first storage area, or

 when the unit to perform the I/O control is not the at least one storage control unit, the disk control unit performs the I/O control of the data to the second storage area.

16. (currently amended) A control method according to claim 225, wherein a plurality of the storage control units and at least one disk control unit are mounted in the mounting part, said method further comprising the steps of:

receiving the data I/O request by one of the storage control units;

referring to the information by the one storage control unit to identify a ~~the~~ unit to perform the I/O control to a ~~the~~ storage volume to which the data I/O request is directed; and

performing the I/O control by the one storage control unit when the unit to perform the I/O control is the one storage control unit, performing the I/O control by the at least one disk control unit when the unit to perform the I/O control is the at least one disk unit, or performing the I/O control by another storage control unit when the unit to perform the I/O control is said another storage control unit.

17. (currently amended) A control method according to claim 225, wherein when ~~which~~ at least one storage control unit, one disk control unit, and one cache memory unit are mounted in the mounting part, ~~wherein the~~ memory of the at least one storage control unit includes:

a first storage area for storing the data to be stored in the storage volumes to which the at least one storage control unit performs I/O control, and

a second storage area for storing the data to be stored in the storage volumes to which the one disk control unit performs I/O control, wherein said control method further comprises the steps of:

receiving a data I/O request by the at least one storage control unit;
referring to the information by the at least one storage control unit to
identify ~~a~~ the unit to perform the I/O control to the storage volume to which the
data I/O request is directed;

performing the I/O control to the first storage area by the at least one
storage control unit when the unit to perform the I/O control is the at least one
storage control unit;

performing the I/O control to the one cache memory unit by the at least
one storage control unit when the data is not stored in the first storage area;
and

performing the I/O control to the storage volume by the at least one
storage control unit when the data is not stored in the one cache memory unit.

18. (currently amended) A control method according to claim 225,
wherein when at least one storage control unit, one disk control unit, and one
cache memory unit are mounted in the mounting part, ~~wherein~~ the memory of
the storage control unit includes:

a first storage area for storing ~~the data to be stored in the storage~~
volumes to which the at least one storage control unit performs I/O control,
and

a second storage area for storing the data to be stored in the storage
volumes to which the one disk control unit performs I/O control,

wherein said control method further comprises the steps of:

receiving a data I/O request by the at least one storage control unit;

referring to the information by the at least one storage control unit to identify a the-unit to perform the I/O control to a the-storage volume to which the data I/O request is directed;

performing the I/O control to the second storage area by the at least one storage control unit when the unit to perform the I/O control is the one disk control unit;

performing the I/O control to the one cache memory unit by the at least one storage control unit when the data is not stored in the second storage area; and

performing the I/O control to the at least one storage volume by the at least one storage control unit when the data is not stored in the one cache memory unit.

19. (currently amended) A control method according to claim 225, wherein when a the-cache memory unit is mounted in the mounting part, said control method further comprising the step of:

duplicating information stored in the memory of each of the storage control units by each of the storage control units, for identifying a the-unit to perform the I/O control to a the-storage volume to which the data I/O request is directed, and write the duplicated information into the cache memory unit, wherein:

said step of referring to the information by the storage control unit to identify a the-unit to perform the I/O control to a the-storage volume to which the I/O request is directed comprises:

a step of referring to ~~the~~ information in the cache memory unit by the storage control unit to identify the unit when the storage control unit cannot identify the unit merely by consulting the information stored in the memory of the storage control unit.

20. (currently amended) A control method according to claim 225, ~~wherein~~ wherein when a the disk control unit is mounted in the mounting part, said control method further comprising the steps of:

duplicating ~~the~~ data stored in ~~the~~ a storage volume to which ~~the~~ a storage control unit performs I/O control by one of the storage control units, and write the duplicated data into the storage volume to which the disk control unit performs I/O control; and

changing ~~the~~ information, stored in the respective memories of the storage control unit and another storage control unit for identifying a ~~the~~ unit to perform the I/O control, from the storage control unit to the disk control unit.

21. (new) A storage device control apparatus according to claim 1, further comprising:

a mounting part which removably mounts each of said channel control units, said disk control units, said cache memory units, and said storage control units in said storage device control section in a manner to be independent of one another to permit independent connection or disconnection of each of said units to said internal connection part.

22. (new) A control method according to claim 5, wherein said storage device control apparatus further includes:

a mounting part which removably mounts each of said channel control units, said disk control units, said cache memory units, and said storage control units in said storage device control section in a manner to be independent of one another to permit independent connection or disconnection of each of said units to said internal connection part.